

Supplemental Material

Current Status of the Epidemiologic Evidence Linking Polychlorinated Biphenyls and Non-Hodgkin Lymphoma, and the Role of Immune Dysregulation

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Supplemental Material, Literature Search Key Words.

Question 1: PCB-NHL Weight of Evidence Analysis

Key words and indexing terms included relevant combinations of the following terms: “polychlorinated biphenyl”, “PCB”, “Aroclor”, “Arochlor”, “Clophen”, “organochlorine”, “aryl hydrocarbon”, “AhR”, “dioxin-like”, “lymphoma”, “non-Hodgkin”, “NHL”, “lymphohematopoietic”, “hematologic”, “lymphatic”, “lymphosarcoma”, “reticulosarcoma”, “carcinogen”, “cancer”, and “carcinogenicity”.

Question 2: Evidence for the Role of Immune Dysregulation in Linking PCB Exposure and NHL Risk.

Key words and indexing terms included relevant combinations of the following terms: “polychlorinated biphenyl”, “PCB”, “Aroclor”, “Arochlor”, “Clophen”, “organochlorine”, “dioxin-like”, “immune”, “inflammation”, “autoimmune”, “immunotoxic”, “immunodeficiency”, “Epstein Barr virus”, “EBV”, “antibody”, and “infection”.

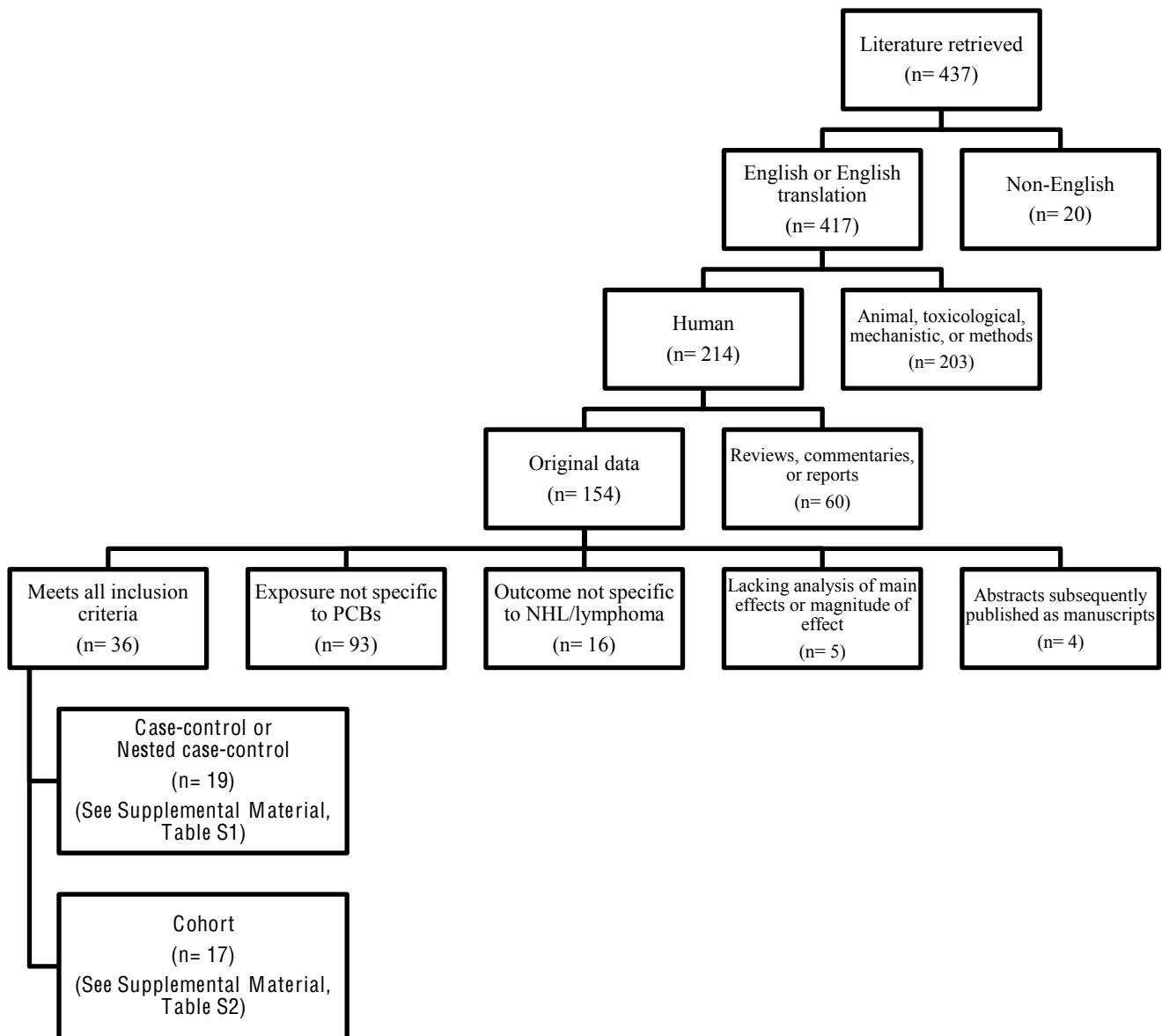
Supplemental Material, Summary of Inclusion/Exclusion Criteria for PCB-NHL Weight of Evidence Analysis.

The titles, abstracts, and full text (when necessary) of all citations resulting from our literature search were reviewed for potential inclusion in the weight of evidence analysis, based on the following inclusion criteria:

- 1) English language or English translation available
- 2) Humans as the primary subject (versus animal, toxicological, mechanistic, and/or methodology as the primary subject)
- 3) Presentation of original data (versus reviews, commentaries, or reports)
- 4) Specific to PCB exposure
- 5) Specific to NHL or lymphoma as an outcome
- 6) Statistical analysis of the main effect of PCB exposure on NHL/lymphoma, including data on magnitude of the effect (versus studies performing no statistical analyses or presenting only p-values)
- 7) For abstracts only: Not subsequently published in manuscript form

Figure S1 presents the numbers of citations excluded based upon each of the above-listed criteria. The relevance of each citation to the inclusion criteria was evaluated in the order of the criteria listed above, and the number of citations excluded for each criterion was counted. It was possible for a particular citation to fail to meet multiple of the inclusion criteria; however, it was only counted under the first criterion which it failed to meet.

Supplemental Material, Figure S1. Results of Literature Search for PCB-NHL Weight of Evidence Analysis.



Supplemental Material, Table S1. Results from Case-Control Studies of the Association Between PCB Exposure and NHL

Citation Study Population	PCB source	Control Matching Variables	PCB Congener or Group	Exposure Level (lipid adjusted)	# Cases	# Controls	OR ^a	95% CI	p-value	Adjustment Variables ^b	
Bertrand et al, 2010 Physicians' Health Study	Plasma	Race, age, timing of blood sample, fasting status at blood draw	Σ PCBs	163-167 ng/g lipid	33	81	1.0	reference	trend <0.01	Region, BMI, smoking status, alcohol intake, height	
				>167-742 ng/g lipid	31	82	0.86	0.47 1.6			
				>742-894 ng/g lipid	34	82	0.99	0.55 1.8			
				>894-1121 ng/g lipid	46	82	1.3	0.71 2.3			
				>1121-5322 ng/g lipid	61	82	1.6	0.91 2.9			
			Σ Immunotoxic PCBs	24-113 ng/g lipid	32	81	1.0	reference	trend 0.09		
				>113-145 ng/g lipid	35	82	0.98	0.54 1.8			
				>145-189 ng/g lipid	36	82	0.99	0.55 1.8			
				>189-245 ng/g lipid	45	82	1.2	0.64 2.1			
				>245-1813 ng/g lipid	57	82	1.4	0.80 2.6			
			Σ PCB 118, 138, 153, 180	35-275 ng/g lipid	31	81	1.0	reference	trend <0.01		
				>275-344 ng/g lipid	32	82	0.96	0.53 1.8			
				>344-423 ng/g lipid	36	82	1.1	0.60 2.0			
				>423-525 ng/g lipid	38	82	1.1	0.59 2.1			
				>525-2440 ng/g lipid	68	82	1.8	1.0 3.2			
			PCB 118	4.0-42 ng/g lipid	33	81	1.0	reference	trend 0.15		
				>42-56 ng/g lipid	29	82	0.8	0.42 1.5			
				>56-77 ng/g lipid	40	82	1.1	0.59 2.0			
				>77-105 ng/g lipid	46	82	1.2	0.63 2.2			
				>105-734 ng/g lipid	57	82	1.4	0.76 2.5			
			PCB 138	4.0-59 ng/g lipid	29	81	1.0	reference	trend 0.02		
				>59-76 ng/g lipid	38	82	1.3	0.68 2.3			
				>76-97 ng/g lipid	38	82	1.2	0.64 2.1			
				>97-122 ng/g lipid	37	82	1.2	0.64 2.2			
				>122-541 ng/g lipid	63	82	1.8	0.98 3.2			
			PCB 153	6.1-95 ng/g lipid	28	81	1.0	reference	trend <0.01		
				>95-122 ng/g lipid	37	82	1.2	0.67 2.3			
				>122-148 ng/g lipid	36	82	1.3	0.68 2.4			
				>148-188 ng/g lipid	37	82	1.2	0.62 2.2			
				>188-761 ng/g lipid	67	82	2.1	1.1 3.8			
			PCB 180	21-68 ng/g lipid	25	81	1.0	reference	trend <0.01		
				>68-84 ng/g lipid	40	82	1.5	0.82 2.7			
				>84-102 ng/g lipid	35	82	1.4	0.75 2.7			
				>102-126 ng/g lipid	44	82	1.8	0.96 3.3			
				>126-528 ng/g lipid	61	82	2.4	1.3 4.5			

Supplemental Material, Table S1 (continued).

Citation Study Population	PCB source	Control Matching Variables	PCB Congener or Group	Exposure Level (lipid adjusted)	# Cases	# Controls	OR ^a	95% CI	p-value	Adjustment Variables ^b
Cocco et al, 2008 Participants in Epilymph case-control study from France, Germany, and Spain	Plasma	None. Plasma samples for controls randomly sampled from Epilymph study participants	Σ PCBs	≤ 200.42 ppb	41	51	1.0	reference		Age, gender, education, study center
				200.43-387.79 ppb	50	51	1.2	0.6 2.2	trend 0.83	
				387.80-576.36 ppb	33	50	0.7	0.3 1.4		
			Σ Immunotoxic PCBs	≥ 576.37 ppb	50	51	1.0	0.5 2.0		
				≤ 153.46 ppb	38	51	1.0	reference		
				153.47-215.38 ppb	37	50	1.0	0.5 1.8	trend 0.76	
			Σ BRCA1 inhibitors	215.39-334.14 ppb	48	51	1.1	0.6 2.1		
				≥ 334.15 ppb	51	51	1.1	0.6 2.1		
				≤ 135.46 ppb	41	51	1.0	reference		
			Σ Pseudo-estrogen PCBs	135.47-215.38 ppb	31	50	0.8	0.4 1.5		
				215.39-334.14 ppb	55	51	1.3	0.7 2.5	trend 0.77	
				≥ 334.15 ppb	47	51	1.0	0.5 1.9		
			Σ High chlorinated anti-estrogenic PCBs	≤ 83.81 ppb	39	51	1.0	reference		
				83.82-166.75 ppb	44	50	1.1	0.6 2.1		
				166.76-290.85 ppb	40	51	0.9	0.4 1.8	trend 0.63	
			Σ Phenobarbital-inducer PCBs	≥ 290.86 ppb	51	51	1.2	0.6 2.5		
				≤ 0.30 ppb	20	22	1.0	reference		
				0.31-65.63 ppb	42	60	0.9	0.4 1.9	trend 0.96	
			Σ Phenobarbital and 3-methyl cholanthrene mixed inducer PCBs	65.64-113.43 ppb	49	59	0.9	0.4 2.2		
				≥ 113.44 ppb	63	62	1.0	0.4 2.2		
				≤ 99.540 ppb	39	60	1.0	reference		
			Σ PCB 28	99.55-161.85 ppb	46	47	1.5	0.8 2.7		
				161.86-237.29 ppb	35	48	1.0	0.5 2.0	trend 0.59	
				≥ 237.30 ppb	54	48	1.3	0.7 2.5		
			Σ PCB 118	≤ 57.95 ppb	40	54	1.0	reference		
				57.96-106.03 ppb	41	48	1.4	0.7 2.7	trend 0.74	
				106.04-192.91 ppb	56	50	1.5	0.8 2.8		
			Σ PCB 138	≥ 192.92 ppb	37	51	0.9	0.5 1.8		
				≤ 10.50 ppb	83	99	1.0	reference		
				10.51-31.70 ppb	25	34	0.9	0.4 1.8	trend 0.23	
			Σ PCB 153	31.71-67.94 ppb	21	34	0.7	0.3 1.5		
				≥ 67.95 ppb	45	36	1.6	0.8 3.2		
				≤ 12.30 ppb	94	100	1.0	reference		
			Σ PCB 170	12.31-38.76 ppb	41	34	1.0	0.5 2.0		
				38.77-59.17 ppb	20	34	0.5	0.2 1.0	trend 0.004	
				≥ 59.18 ppb	19	35	0.4	0.2 0.8		
			Σ PCB 180	≤ 45.73 ppb	51	66	1.0	reference		
				45.74-72.41 ppb	37	46	1.1	0.6 1.9		
				72.42-116.12 ppb	42	45	1.1	0.6 2.0	trend 0.88	
			Σ PCB 180	≥ 116.13 ppb	44	46	1.1	0.6 2.0		
				≤ 62.56 ppb	43	65	1.0	reference		
				62.57-100.66 ppb	51	46	1.5	0.8 2.8		
			Σ PCB 180	100.67-142.43 ppb	28	46	0.8	0.4 1.6	trend 0.70	
				≥ 142.44 ppb	52	46	1.3	0.7 2.5		
				≤ 0.20 ppb	53	65	1.0	reference		
			Σ PCB 180	0.21-21.53 ppb	40	46	1.1	0.5 2.2		
				21.54-34.28 ppb	36	45	0.8	0.4 1.7	trend 0.83	
				≥ 34.29 ppb	45	47	1.0	0.5 1.8		
			Σ PCB 180	≤ 0.30 ppb	23	32	1.0	reference		
				0.31-51.22 ppb	40	57	1.2	0.6 2.6		
				51.23-85.93 ppb	50	56	1.4	0.6 3.0	trend 0.31	
				≥ 85.94 ppb	61	58	1.5	0.7 3.2		

Supplemental Material, Table S1 (continued).

Citation Study Population	PCB source	Control Matching Variables	PCB Congener or Group	Exposure Level (lipid adjusted)	# Cases	# Controls	OR ^a	95% CI	p-value	Adjustment Variables ^b
Colt et al, 2005 NCI-SEER study	Carpet dust	Frequency matched on age, sex, race, study center	Σ PCBs	all below UDL any above UDL 21.9-82.5 ng/g 82.5-202.8 ng/g 203.8-23,380 ng/g	315 288 88 114 92	262 181 57 63 61	1.0 1.5 1.4 1.6 1.5	reference 1.2 2.0 0.9 2.1 1.1 2.4 1.0 2.2	trend 0.14	Study center, sex, age, education
			PCB 105	below UDL above UDL 20.8-31.0 ng/g 31.3-73.0 ng/g 75.8-3,860 ng/g	486 117 40 43 34	368 75 24 26 25	1.0 1.2 1.3 1.4 1.1	reference 0.9 1.7 0.8 2.2 0.8 2.4 0.6 1.9	trend 0.74	
			PCB 138	below UDL above UDL 20.8-33.6 ng/g 33.7-84.2 ng/g 84.9-10,200 ng/g	398 205 64 83 58	305 138 46 46 46	1.0 1.3 1.2 1.6 1.1	reference 1.0 1.7 0.8 1.8 1.1 2.4 0.7 1.7	trend 0.95	
			PCB 153	below UDL above UDL 20.8-32.9 ng/g 33.1-74.2 ng/g 74.5-6,460 ng/g	351 252 74 101 77	280 163 54 55 54	1.0 1.4 1.2 1.7 1.3	reference 1.1 1.8 0.8 1.7 1.2 2.5 0.9 2.0	trend 0.34	
			PCB 170	below UDL above UDL 20.8-28.3 ng/g 28.6-52.9 ng/g 53.7-1,380 ng/g	509 94 30 31 33	389 54 18 18 18	1.0 1.5 1.4 1.5 1.5	reference 1.0 2.1 0.8 2.6 0.8 2.7 0.8 2.7	trend 0.17	
			PCB 180	below UDL above UDL 20.8-31.6 ng/g 31.8-54.5 ng/g 55.3-2,870 ng/g	432 171 52 55 64	338 105 35 35 35	1.0 1.5 1.3 1.5 1.7	reference 1.1 2.0 0.8 2.1 0.9 2.3 1.1 2.6	trend 0.03	
Colt et al, 2009 NCI-SEER study	Carpet dust	Frequency matched on age, sex, race, study center	PCB 180	per 10% increase in exposure (ng/g)	682	513	RR= 0.7%	0.0% 1.3%	p=0.041	Age, sex, race, education, study center
	Plasma		PCB 180	per 10% increase in exposure (pg/g lipid)	100	100	RR= 8.3%	1.9% 14.6%	p=0.009	
			Σ TEQ	per 10% increase in exposure (pg/g lipid)	96	95	RR= 7.8%	1.1% 17.2%	p=0.022	

Supplemental Material, Table S1 (continued).

Citation Study Population	PCB source	Control Matching Variables	PCB Congener or Group	Exposure Level (lipid adjusted)	# Cases	# Controls	OR ^a	95% CI	p-value	Adjustment Variables ^b
De Roos et al, 2005 NCI-SEER study	Plasma	Age, date of blood draw, sex, study site	Σ Noncoplanar PCBs	≤0.445 mol/g lipid >0.445-0.667 mol/g lipid >0.667-0.900 mol/g lipid >0.900 mol/g lipid <i>per 0.01 mol/g lipid</i>	19 21 25 27 --	22 25 24 23 --	1.0 1.30 1.66 1.85 1.003	reference 0.51 3.35 0.61 4.53 0.67 5.14 0.996 1.010	trend 0.24	Age, sex, study site, date of blood draw
			Σ Low chlorinated PCBs	≤0.027 mol/g lipid >0.027-0.046 mol/g lipid >0.046-0.066 mol/g lipid >0.066 mol/g lipid <i>per 0.01 mol/g lipid</i>	25 28 16 31 --	26 25 24 25 --	1.0 1.12 0.73 1.26 1.05	reference 0.51 2.45 0.30 1.75 0.52 3.03 0.95 1.15	trend 0.66	
			Σ Moderately chlorinated PCBs	≤0.385 mol/g lipid >0.385-0.599 mol/g lipid >0.599-0.785 mol/g lipid >0.785 mol/g lipid <i>per 0.01 mol/g lipid</i>	19 25 20 29 --	23 23 24 24 --	1.0 1.52 1.43 1.88 1.003	reference 0.58 4.01 0.49 4.11 0.67 5.26 0.996 1.011	trend 0.29	
			Σ High chlorinated PCBs	≤0.018 mol/g lipid >0.018-0.026 mol/g lipid >0.026-0.036 mol/g lipid >0.036 mol/g lipid <i>per 0.01 mol/g lipid</i>	17 24 20 37 --	25 25 25 25 --	1.0 1.59 1.35 2.68 1.17	reference 0.62 4.04 0.53 3.48 1.04 6.90 0.99 1.39	trend 0.04	
			Σ PCB TEQ	≤6.40 pg/g lipid >6.40-8.69 pg/g lipid >8.69-13.17 pg/g lipid >13.17 pg/g lipid <i>per 10 pg/g lipid</i>	28 16 20 33 --	24 25 23 24 --	1.0 0.59 0.86 1.51 1.34	reference 0.25 1.40 0.38 1.98 0.62 3.67 0.85 2.12	trend 0.15	
			PCB 74	≤7.8 ng/g lipid >7.8-13.3 ng/g lipid >13.3-19.3 ng/g lipid >19.3 ng/g lipid <i>per 10 ng/g lipid</i>	25 28 16 31 --	26 25 24 25 --	1.0 1.12 0.73 1.26 1.16	reference 0.51 2.45 0.30 1.75 0.52 3.03 0.85 1.59	trend 0.66	
			PCB 99	≤5.6 ng/g lipid >5.6-9.3 ng/g lipid >9.3-16.1 ng/g lipid >16.1 ng/g lipid <i>per 10 ng/g lipid</i>	24 22 30 24 --	25 25 25 25 --	1.0 0.63 1.04 0.77 0.94	reference 0.24 1.68 0.45 2.39 0.28 2.10 0.76 1.17	trend 1.00	
			PCB 118	≤8.1 ng/g lipid >8.1-11.8 ng/g lipid >11.8-25.8 ng/g lipid >25.8 ng/g lipid <i>per 10 ng/g lipid</i>	29 14 30 24 --	24 25 24 24 --	1.0 0.36 0.91 0.73 0.98	reference 0.13 0.98 0.42 1.98 0.29 1.84 0.82 1.18	trend 0.88	
			PCB 126	≤18.9 pg/g lipid >18.9-30.3 pg/g lipid >30.3-52.7 pg/g lipid >52.7 pg/g lipid <i>per 10 pg/g lipid</i>	29 20 21 30 --	25 25 25 24 --	1.0 0.65 0.73 1.09 1.02	reference 0.29 1.49 0.31 1.72 0.49 2.41 0.95 1.10	trend 0.54	
			PCB 156	≤5.5 ng/g lipid >5.5-7.8 ng/g lipid >7.8-9.8 ng/g lipid >9.8 ng/g lipid <i>per 10 ng/g lipid</i>	17 27 16 40 --	22 30 26 22 --	1.0 1.70 1.02 2.70 1.69	reference 0.48 6.03 0.32 3.26 0.97 7.50 0.91 3.11	trend 0.03	

Supplemental Material, Table S1 (continued).

Citation Study Population	PCB source	Control Matching Variables	PCB Congener or Group	Exposure Level (lipid adjusted)	# Cases	# Controls	OR ^a	95% CI	p-value	Adjustment Variables ^b	
De Roos et al, 2005 (continued)			PCB 169	≤18.5 pg/g lipid	22	26	1.0	reference	trend 0.11	Age, sex, study site, date of blood draw	
				>18.5-28.4 pg/g lipid	23	24	1.14	0.49 2.66			
				>28.4-37.7 pg/g lipid	20	25	1.08	0.41 2.82			
				>37.7 pg/g lipid <i>per 10 ng/g lipid</i>	35	24	2.62	0.88 7.80			
			PCB 138-158	--	--	1.47	1.13 1.91				
				≤25.2 ng/g lipid	26	25	1.0	reference	trend 0.53		
				>25.2-38.3 ng/g lipid	20	25	0.82	0.38 1.78			
				>38.3-55.5 ng/g lipid	25	25	1.04	0.47 2.33			
			PCB 146	>55.5 ng/g lipid <i>per 10 ng/g lipid</i>	29	25	1.22	0.49 3.05			
				--	--	1.02	0.93 1.12				
				≤4.4 ng/g lipid	20	28	1.0	reference	trend 0.17		
				>4.4-6.0 ng/g lipid	24	23	1.06	0.36 3.08			
			PCB 153	>6.0-8.7 ng/g lipid	24	24	1.37	0.50 3.79			
				>8.7 ng/g lipid <i>per 10 ng/g lipid</i>	32	25	1.81	0.70 4.64			
				--	--	1.54	0.81 2.95				
				≤37 ng/g lipid	23	25	1.0	reference	trend 0.40		
			PCB 170	>37-56.2 ng/g lipid	27	25	1.36	0.57 3.25			
				>56.2-71.3 ng/g lipid	16	25	0.80	0.32 2.03			
				>71.3 ng/g lipid <i>per 10 ng/g lipid</i>	34	25	1.59	0.63 4.00			
				--	--	1.03	0.96 1.12				
			PCB 180	≤12.2 ng/g lipid	22	25	1.0	reference	trend 0.13	Age, sex, study site, date of blood draw	
				>12.2-17 ng/g lipid	16	24	0.84	0.36 1.92			
				>17-22.5 ng/g lipid	27	24	1.59	0.63 4.02			
				>22.5 ng/g lipid <i>per 10 ng/g lipid</i>	31	24	1.73	0.73 4.14			
			PCB 183	--	--	1.24	0.94 1.63				
				≤28.7 ng/g lipid	16	26	1.0	reference	trend 0.01		
				>28.7-41.2 ng/g lipid	21	24	1.72	0.65 4.54			
				>41.2-54.4 ng/g lipid	22	25	1.82	0.70 4.76			
			PCB 187	>54.4 ng/g lipid <i>per 10 ng/g lipid</i>	41	25	3.50	1.34 9.15			
				--	--	1.08	0.98 1.20				
				≤2.7 ng/g lipid	30	25	1.0	reference	trend 0.96		
				>2.7-4.4 ng/g lipid	21	20	0.93	0.16 5.46			
			PCB 194	>4.4-6.3 ng/g lipid	22	27	0.73	0.26 2.06			
				>6.3 ng/g lipid <i>per 10 ng/g lipid</i>	27	28	1.02	0.36 2.93			
				--	--	0.91	0.42 1.97				
				≤8.8 ng/g lipid	24	25	1.0	reference	trend 0.18		
			PCB 187	>8.8-12.0 ng/g lipid	13	25	0.59	0.22 1.57			
				>12.0-18.0 ng/g lipid	33	25	1.34	0.59 3.04			
				>18.0 ng/g lipid <i>per 10 ng/g lipid</i>	30	25	1.22	0.49 3.08			
				--	--	1.09	0.84 1.42				
			PCB 194	≤7.9 ng/g lipid	17	25	1.0	reference	trend 0.04	Age, sex, study site, date of blood draw	
				>7.9-11.2 ng/g lipid	24	25	1.59	0.62 4.04			
				>11.2-15.6 ng/g lipid	20	25	1.35	0.53 3.48			
				>15.6 ng/g lipid <i>per 10 ng/g lipid</i>	37	25	2.68	1.04 6.90			
				--	--	1.45	0.98 2.15				

Supplemental Material, Table S1 (continued).

Supplemental Material, Table S1 (continued).

Citation Study Population	PCB source	Control Matching Variables	PCB Congener or Group	Exposure Level (lipid adjusted)	# Cases	# Controls	OR ^a	95% CI	p-value	Adjustment Variables ^b
Fritschi et al, 2005 NHL cases and population control residents of New South Wales or the Australian Capital Territory	Occupational exposure estimated by occupational hygienist based on self-reported occupational history	Frequency matched on age, sex, region of residence	Ever occupationally exposed to PCBs	No Yes	682 12	681 13	1.0 1.10	reference 0.49 2.44	--	Age, sex, state of residence, ethnic origin
			Probability of exposure to PCBs	No Possible Probable	NR NR NR	NR 0.40 4.54	1.0 0.12 1.31 0.97 21.2	reference	--	
			Level of exposure to PCBs	None Low Medium High	NR NR NR NR	NR 1.91 0.78 ---	1.0 0.75 4.85 0.17 3.5 ---	reference	trend 0.90	
			Frequency of exposure to PCBs	Never ≤4 days per year >4 days per year	NR NR NR	NR 1.44 1.15	1.0 0.49 4.22 0.35 3.81	reference	trend 0.60	
			Years of exposure to PCBs	Never <5 years ≥5 years	NR NR NR	NR 1.04 1.13	1.0 0.26 4.19 0.43 2.97	reference	trend 0.80	
Greenland et al, 1994 Mortality study among employees at a transformer manufacturing plant in the US	Occupational exposure estimated based on work history records	None. Controls were workers who died of causes thought to be unrelated to the occupational exposures under study	Exposure to Pyranol (a mixture of ~50% PCBs and ~50% trichlorobenzene)	Indirect or no exposure Direct exposure	NR NR	NR 3.26 ^c	1.0 1.14	reference 9.32	trend >0.40	Age, death year
				Indirect or no exposure 97th percentile of exposure (in controls)	NR NR	NR 1.5 ^c	1.0 0.55	reference 4.3	p=0.42	Age at death, death year, hire year
Hardell et al, 1996/1997 NHL cases and surgical controls in Sweden	Adipose	Frequency matched on age and sex	Σ PCBs	below median (1300 ng/g lipid) above median (1300 ng/g lipid)	NR 16	NR 2.7	1.0 0.8	reference 9.4	--	--
				below median (1300 ng/g lipid) above median (1300 ng/g lipid)	NR NR	NR 1.8	1.0 0.4	reference 7.4	--	Age, sex
Hardell et al, 2001 NHL cases, surgical controls, and population controls in Sweden	Adipose or plasma	Surgical patient controls (n=47) frequency matched on age and sex; Controls randomly sampled from population (n=36) matched on age and sex	Σ PCBs	below median (1020 ng/g lipid) above median (1020 ng/g lipid)	31 51	42 41	1.0 1.8	reference 0.85 3.9	--	Age, sex, BMI, specimen type
				below median (1020 ng/g lipid) above median (1020 ng/g lipid)	53 29	51 32	1.0 1.1	reference 0.28 3.9	--	Age, sex, BMI, specimen type, hexachlorobenzene, p,p'-DDE, Σ chlordanes, TBDE
			Σ Immunotoxic PCBs	below median (355 ng/g lipid) above median (355 ng/g lipid)	25 57	40 43	1.0 3.2	reference 1.4 7.4	--	Age, sex, BMI, specimen type

Supplemental Material, Table S1 (continued).

Citation Study Population	PCB source	Control Matching Variables	PCB Congener or Group	Exposure Level (lipid adjusted)	# Cases	# Controls	OR ^a	95% CI	p-value	Adjustment Variables ^b
Hardell et al, 2009 NHL cases and population controls in Sweden	Plasma	Frequency matched on age and sex	Σ PCBs	below median (646 ng/g lipid) above median (646 ng/g lipid)	40 59	50 49	1.0 2.0	reference 0.99 3.9	--	Age, sex, BMI
			Σ Lower chlorinated PCBs	below median (8.1 ng/g lipid) above median (8.1 ng/g lipid)	52 47	50 49	1.0 1.1	reference 0.6 2.0	--	
			Σ Moderately chlorinated PCBs	below median (559 ng/g lipid) above median (559 ng/g lipid)	41 58	50 49	1.0 1.8	reference 0.9 3.6	--	
			Σ Higher chlorinated PCBs	below median (13 ng/g lipid) above median (13 ng/g lipid)	36 63	50 49	1.0 1.7	reference 0.8 3.4	--	
			Σ Immunotoxic PCBs	below median (226 ng/g lipid) above median (226 ng/g lipid)	45 54	50 49	1.0 1.5	reference 0.8 3.4	--	
Laden et al, 2010 Nurses' Health Study	Plasma	Age, race, month of blood draw, fasting status at blood draw	Σ PCBs	median 406.9 ng/g lipid median 547.8 ng/g lipid median 678.0 ng/g lipid median 945.4 ng/g lipid	33 41 41 30	72 73 73 72	1.0 1.25 1.32 1.02	reference 0.68 2.28 0.71 2.43 0.53 1.95	trend 0.76	Race, age at blood draw, year and month of blood draw, fasting status at blood draw, region, BMI, current smoking status, parity/breastfeeding, height
				median 75.6 ng/g lipid median 111.5 ng/g lipid median 149.6 ng/g lipid median 228.7 ng/g lipid	34 56 30 25	72 73 73 72	1.0 1.83 0.94 0.89	reference 1.01 3.31 0.51 1.76 0.45 1.77	trend 0.48	
			Σ PCB 118, 138, 153, 180	median 185.7 ng/g lipid median 257.5 ng/g lipid median 334.4 ng/g lipid median 471.7 ng/g lipid	33 36 48 28	72 73 73 72	1.0 1.04 1.63 0.91	reference 0.57 1.92 0.90 2.95 0.48 1.75	trend 0.63	
				median 27.4 ng/g lipid median 42.9 ng/g lipid median 61.0 ng/g lipid median 104.7 ng/g lipid	38 49 31 27	72 73 73 72	1.0 1.39 0.89 0.81	reference 0.78 2.47 0.48 1.64 0.42 1.56	trend 0.42	
			PCB 138	median 34.3 ng/g lipid median 53.2 ng/g lipid median 75.7 ng/g lipid median 113.3 ng/g lipid	31 39 48 27	72 73 73 72	1.0 1.33 1.61 0.95	reference 0.73 2.40 0.89 2.92 0.49 1.83	trend 0.59	
				median 64.9 ng/g lipid median 91.2 ng/g lipid median 120.3 ng/g lipid median 170 ng/g lipid	37 33 45 30	72 73 73 72	1.0 0.85 1.38 0.82	reference 0.47 1.54 0.76 2.51 0.43 1.56	trend 0.55	
			PCB 180	median 47.8 ng/g lipid median 63.4 ng/g lipid median 80.5 ng/g lipid median 109.4 ng/g lipid	36 33 44 32	72 73 73 72	1.0 1.02 1.24 1.03	reference 0.54 1.93 0.66 2.31 0.52 2.02	trend 0.82	

Supplemental Material, Table S1 (continued).

Citation Study Population	PCB source	Control Matching Variables	PCB Congener or Group	Exposure Level (lipid adjusted)	# Cases	# Controls	OR ^a	95% CI	p-value	Adjustment Variables ^b
Maifredi et al, 2010 Residents of a municipality in Brescia, Italy with soil contamination by PCBs from a PCB-production factory	Lifetime residential history in a contaminated area (based on PCB concentrations in soil samples) <u>Area D:</u> least contaminated area <u>Area A:</u> most highly contaminated area <u>Area B:</u> Intermediate levels of contamination <u>Area C:</u> Intermediate levels of contamination (lower than area B)	Frequency matched on age and sex	Σ PCBs in soil <i>All cases (incident and deaths)</i>	area D area A area B area C areas A, B, C	462 1 25 7 33	1394 8 55 10 73	1.0 0.4 1.4 2.1 1.4	reference 0.1 3.0 0.8 2.2 0.8 5.5 0.9 2.1	NR NR NR NR	Age, gender
			Σ PCBs in soil <i>Incident cases only</i>	area D area A area B area C areas A, B, C	265 1 17 4 22	1394 8 55 10 73	1.0 0.7 1.6 2.0 1.6	reference 0.1 5.5 0.9 2.8 0.6 6.6 0.9 2.5	NR NR NR p=0.08	Age, gender
			Σ PCBs in soil <i>All cases (incident and deaths); 10+ years duration of residence</i>	area D area A area B area C areas A, B, C	394 15 55 12 80	1208 26 129 25 176	1.0 1.8 1.3 1.5 1.4	reference 0.9 3.9 0.9 1.8 0.7 3.0 1.1 1.8	p=0.08 NR NR p=0.02	Age, gender
			Σ PCBs in soil <i>Incident cases only; 10+ years duration of residence</i>	area D area A area B area C areas A, B, C	394 8 31 6 44	1208 26 129 25 176	1.0 1.7 1.2 1.2 1.3	reference 0.7 3.8 0.8 1.9 0.5 3.0 0.9 1.8	NR NR NR NR	Age, gender
Morton et al, 2008 NCI-SEER study	Carpet dust	Frequency matched on age, sex, race, study center	PCB 180	<20.8 ng/g 20.8-44.3 ng/g ≥44.4 ng/g	499 92 91	395 60 58	1.0 1.3 1.4	reference 0.9 1.9 1.0 2.0	trend 0.07	Age, sex, race, study center, education
Nordstrom et al, 2000 Hairy-cell leukemia cases and population controls in Sweden	Plasma	Age, sex, county	Σ PCBs	≤831.6 ng/g lipid >831.6 ng/g lipid	31 23	27 27	1.0 0.8	reference 0.3 1.9	--	Age, BMI, exposure to herbicides, fungicides, insecticides, impregnating agents, organic solvents, animals, exhausts
Quintana et al, 2004 Cadaver and surgical patient adipose samples for NHL cases, accident victim controls, and MI controls from the US	Adipose	Age, sex, geographic region, race	Σ PCBs	Trace, not detected, or <1 ppm 1-3 ppm >3 ppm	79 50 9	184 151 23	1.0 1.05 1.08	reference 0.63 1.76 0.40 2.92	--	Year of sample collection
Rothman et al, 1997 CLUE I cohort	Serum	Race, sex, date of birth, participation in CLUE I or CLUE I/II, date of sample donation, participation in further surveys, location of specimen storage	Σ PCBs	247-641 ng/g lipid 649-806 ng/g lipid 814-1060 ng/g lipid 1070-2070 ng/g lipid	10 13 21 30	37 37 37 36	1.00 1.3 2.7 4.1	reference 0.5 3.3 0.9 7.8 1.4 11.9	trend 0.002	DDT, race, sex, date of birth, participation in CLUE I or CLUE I/II, date of sample donation, participation in further surveys, location of specimen storage

Supplemental Material, Table S1 (continued).

Citation Study Population	PCB source	Control Matching Variables	PCB Congener or Group	Exposure Level (lipid adjusted)	# Cases	# Controls	OR ^a	95% CI	p-value	Adjustment Variables ^b
Spinelli et al, 2007 NHL cases and population controls in British Columbia, Canada	Plasma	Frequency matched on sex, age, residential location	Σ PCBs	≤ 100.9 ng/g lipid	81	115	1.00	reference		
				>100.9-155.6 ng/g lipid	103	114	1.41	0.93 2.14	trend 0.001	Age, family history of NHL
				>155.6-220.0 ng/g lipid	77	115	1.11	0.71 1.74		
				>220.0-6571 ng/g lipid	142	115	2.14	1.38 3.30		
			Σ Dioxin-like PCBs	≤ 10.12 ng/g lipid	82	115	1.00	reference		
				>10.12-15.35 ng/g lipid	96	114	1.41	0.91 2.16	trend <0.001	Age, farming
				>15.35-23.72 ng/g lipid	82	115	1.57	1.00 2.46		
				>23.72-280.8 ng/g lipid	143	115	2.40	1.53 3.77		
			Σ Non-dioxin-like PCBs	≤ 88.57 ng/g lipid	85	115	1.00	reference		
				>88.57-136.2 ng/g lipid	96	115	1.30	0.85 1.97	trend <0.001	Age, region, family history of NHL
				>136.2-196.4 ng/g lipid	93	115	1.19	0.76 1.86		
				>196.4-6445 ng/g lipid	148	115	2.18	1.41 3.38		
			PCB 105	not detected	281	316	1.00	reference		
				>1.32-37.65 ng/g lipid	132	139	1.06	0.80 1.42	trend 0.675	Education
			PCB 118	≤ 4.57 ng/g lipid	82	109	1.00	reference		
				>4.57-7.78 ng/g lipid	88	113	1.12	0.74 1.69	trend 0.004	Age, BMI, farming
				>7.78-12.85 ng/g lipid	95	114	1.23	0.81 1.88		
			PCB 156	>12.85-202.1 ng/g lipid	129	113	1.77	1.15 2.72		
				≤ 3.65 ng/g lipid	85	114	1.00	reference		
				>3.65-5.51 ng/g lipid	85	114	1.10	0.72 1.68	trend 0.004	Age, farming
				>5.51-8.32 ng/g lipid	105	115	1.43	0.93 2.21		
				>8.32-113.3 ng/g lipid	128	115	1.77	1.14 2.74		
			PCB 28	not detected	348	376	1.00	reference		
				>1.38-54.47 ng/g lipid	74	84	0.95	0.67 1.34	trend 0.779	None
			PCB 99	≤ 3.06 ng/g lipid	106	113	1.00	reference		
				>3.06-4.83 ng/g lipid	82	115	0.78	0.52 1.15	trend 0.045	Age, farming
				>4.83-7.78 ng/g lipid	85	115	0.81	0.54 1.21		
				>7.78-61.34 ng/g lipid	130	115	1.27	0.86 1.87		
			PCB 138	≤ 11.61 ng/g lipid	100	115	1.00	reference		
				>11.61-19.28 ng/g lipid	90	115	0.93	0.62 1.38	trend 0.02	Age
				>19.28-29.72 ng/g lipid	94	115	0.99	0.66 1.50		
				>29.72-289.4 ng/g lipid	138	115	1.46	0.98 2.18		
			PCB 153	≤ 25.29 ng/g lipid	90	115	1.00	reference		
				>25.29-38.68 ng/g lipid	86	115	1.04	0.68 1.57	trend 0.002	Age
				>38.68-59.0 ng/g lipid	106	115	1.34	0.87 2.04		
				>59.0-735.9 ng/g lipid	140	115	1.79	1.17 2.72		
			PCB 170	≤ 7.16 ng/g lipid	88	115	1.00	reference		
				>7.16-11.17 ng/g lipid	93	115	1.17	0.77 1.79	trend 0.005	Age
				>11.17-17.23 ng/g lipid	107	115	1.41	0.91 2.18		
				>17.23-230.1 ng/g lipid	134	115	1.80	1.16 2.79		
			PCB 180	≤ 21.93 ng/g lipid	85	111	1.00	reference		
				>21.93-35.63 ng/g lipid	94	110	1.28	0.82 2.00	trend 0.005	Age, sex, BMI, ethnicity, family history of NHL
				>35.63-54.72 ng/g lipid	89	115	1.25	0.78 2.00		
				>54.72-3787 ng/g lipid	126	113	1.91	1.19 3.07		
			PCB 183	not detected	162	177	1.00	reference		
				>1.87-3.95 ng/g lipid	107	142	0.83	0.59 1.18	trend 0.113	Age
			PCB 187	>3.95-84.86 ng/g lipid	153	141	1.22	0.87 1.71		
				≤ 5.93 ng/g lipid	88	114	1.00	reference		
				>5.93-9.82 ng/g lipid	98	114	1.27	0.83 1.95	trend 0.003	Age, education, family history of NHL
				>9.82-15.46 ng/g lipid	79	114	1.04	0.66 1.63		
				>15.46-833.2 ng/g lipid	136	112	1.92	1.23 2.98		

Supplemental Material, Table S1 (continued).

Citation Study Population	PCB source	Control Matching Variables	PCB Congener or Group	Exposure Level (lipid adjusted)	# Cases	# Controls	OR ^a	95% CI	p-value	Adjustment Variables ^b
Vigl et al, 2011 Residents of an area of Besancon, France with high levels of dioxin emissions from a municipal solid waste incinerator	Serum	Sex, age, date of blood draw	Σ Dioxin-like PCBs	per pg WHO-TEQ/g lipid	--	--	1.04	1.00 1.07	p=0.02	None
			Σ Non-dioxin-like PCBs	per 10 ng/g lipid	--	--	1.02	1.01 1.05	p=0.01	
			Σ PCDD, PCDF, dioxin-like PCBs	per pg WHO-TEQ/g lipid	--	--	1.04	1.01 1.05	p=0.01	
			PCB 77	per pg WHO-TEQ/g lipid	--	--	∞	-- --	p=0.4	
			PCB 126	per pg WHO-TEQ/g lipid	--	--	1.10	1.00 1.23	p=0.04	
			PCB 169	per pg WHO-TEQ/g lipid	--	--	3.40	1.11 13.04	p=0.03	
			PCB 105	per pg WHO-TEQ/g lipid	--	--	3.29	1.07 13.41	p=0.02	
			PCB 114	per pg WHO-TEQ/g lipid	--	--	1.55	0.97 2.84	p=0.06	
			PCB 118	per pg WHO-TEQ/g lipid	--	--	1.21	1.01 1.53	p=0.02	
			PCB 123	per pg WHO-TEQ/g lipid	--	--	∞	-- --	p=0.02	
			PCB 156	per pg WHO-TEQ/g lipid	--	--	1.09	1.00 1.20	p=0.02	
			PCB 157	per pg WHO-TEQ/g lipid	--	--	1.41	1.03 2.13	p=0.03	
			PCB 167	per pg WHO-TEQ/g lipid	--	--	∞	-- --	p=0.02	
			PCB 189	per pg WHO-TEQ/g lipid	--	--	85.4	2.12 7349.0	p=0.01	
			PCB 138	per 10 ng/g lipid	--	--	1.08	1.01 1.20	p=0.03	
			PCB 153	per 10 ng/g lipid	--	--	1.04	1.00 1.09	p=0.03	
			PCB 180	per 10 ng/g lipid	--	--	1.08	1.01 1.17	p=0.01	

Abbreviations:
 BMI, body mass index; CI, confidence interval; CLUE I, Campaign Against Cancer and Stroke cohort study; DDE, dichlorodiphenyldichloroethylene; DDT, dichlorodiphenyltrichloroethane; MI, myocardial infarction; ng/g, nanograms per gram; NHL, non-Hodgkin lymphoma; NHS, Nurses' Health Study; NR, not reported; OR, odds ratio; PCB, polychlorinated biphenyl; pg/g, picograms per gram; ppb, parts per billion; ppm, parts per million; RR, relative risk; TBDE, 2,2',4,2'-tetrabrominated diphenyl ether; TEQ, toxic equivalency quotient; UDL, usual detection limit; WHO, World Health Organization

^a Results presented only for main effects of PCB exposure on NHL (overall). NHL subtype-specific analyses not presented.

^b In studies with multiple models, fully adjusted models are shown.

^c Odds of lymphoma death.

bold face: statistically significant results at an alpha of 0.05

Supplemental Material, Table S2. Characteristics of Cohort Studies Examining the Association Between Occupational PCB Exposure and NHL or Lymphoma

Citation	Cohort	Cohort Size (n)	Deaths (n)	Duration of Follow-Up	Notes on Cohort Age or Exposure	Outcome	O/E	SMR/SIR (95% CI)
Brown and Jones 1981	Capacitor manufacturers (NY, MA)	2,567	163	35 y (1940-1975)	≥30% of cohort employed for ≤2 y	<i>Mortality:</i> L & H	2 / 4.34	0.46 (p>0.05)
Brown 1987	Capacitor manufacturers (NY, MA)	2,588	295	42 y (1940-1982)	See Brown and Jones 1981	<i>Mortality:</i> L & H	5 / 7.40	0.68 (p>0.05)
Prince et al. 2006a	Capacitor manufacturers (NY, MA)	2,572	798	58 y (1940-1998)	Median age at first employment= 23.3 y; 49% of cohort employed <5 y	<i>Mortality:</i> NHL	10 / 7.63	1.31 (0.63,2.41)
Prince et al. 2006b	Capacitor manufacturers (NY, MA)	14,458	3,417	58 y (1940-1998)	75% of cohort left employment before age 55	<i>Mortality:</i> NHL	35 / 35.71	0.98 (0.68,1.36)
Kimbrough et al. 1999	Capacitor manufacturers (NY)	7,075	1,195	31 y (1946-1977)	Mean duration of employment= 5.6 y; Mean age at start of employment= 27 y	<i>Mortality:</i> LS &RS	3 / 4.62	0.65 (0.13,1.90)
						<i>Mortality:</i> Other L	14 / 14.2	0.98 (0.54,1.65)
Kimbrough et al. 2003	Capacitor manufacturers (NY)	7,075	1,654	52 y (1946-1998)	See Kimbrough et al. 1999	<i>Mortality:</i> LS &RS	3 / 4.8	0.63 (0.13,1.83)
						<i>Mortality:</i> Other L	22 / 21.2	1.04 (0.65,1.57)
Sinks et al. 1992	Capacitor manufacturers (IN)	3,588	192	19 y (1957-1986)	NR	<i>Mortality:</i> L & H	7 / 7.20	1.00 (0.40,2.00)
Ruder et al. 2006	Capacitor manufacturers (IN)	3,569	547	38 y (1960-1998)	Median age at first employment= 24 y; Median duration of employment=1.3 y	<i>Mortality:</i> NHL	9 / 7.32	1.23 (0.60,2.30)

Supplemental Material, Table S2 (continued).

Citation	Cohort	Cohort Size (n)	Deaths (n)	Duration of Follow-Up	Notes on Cohort Age or Exposure	Outcome	O/E	SMR/SIR (95% CI)
Bertazzi et al. 1982	Capacitor manufacturers (Italy)	1,310	27	32 y (1946-1978)	Employment ≥ 6 months required for inclusion; Authors noted “very young age” of workers	<i>Mortality:</i> L & H	4 / 0.91	4.4 (1.2,12.2)
Bertazzi et al. 1987	Capacitor manufacturers (Italy)	2,100	30	36 y (1946-1982)	NR	<i>Mortality:</i> Hemato	3 / 0.80	3.75 (p>0.05)
Tironi et al. 1996	Capacitor manufacturers (Italy)	1,556	47	36 y (1946-1982)	NR	<i>Mortality:</i> L & H	5 / 3.50	1.41 (0.46,3.30)
Mallin et al. 2004	Capacitor manufacturers (IL)	2,885	1,199	66 y (1944-2000)	>55% of cohort employed for ≤1 y	<i>Mortality:</i> LS & RS	3 / 1.96	1.53 (0.32,4.48)
						<i>Mortality:</i> NHL ^a	13 / 7.39	1.76 (0.94,3.02)
Gustavsson et al. 1997	Capacitor manufacturers (Sweden)	241	56	26 y (1965-1991)	NR	<i>Mortality:</i> Lymphoma	1 / 0.39	2.54 (0.07,14.2)
			18 incident cancers			<i>Incidence:</i> NHL	1 / 0.67	1.49 (0.02,8.30)
Liss et al. 1989 ^b	Transformer manufacturers (Ontario)	1,073	146	25 y (1960-1985)	N/A	<i>Mortality:</i> L & H	2 / 0.69	2.90 (0.3,12.4)
Yassi et al. 1994	Transformer manufacturers (Canada)	812	71	39 y (1950-1989)	NR	<i>Mortality:</i> NHL	2 / 0.79	2.54 (0.29,9.17)
Loomis et al. 1997	Electrical power company workers (U.S.)	138,905	20,733	38 y (1950-1988)	Authors noted cohort was “relatively young”	<i>Mortality:</i> LS & RS	69 / 89.6	0.77 (0.60,0.97)
						<i>Mortality:</i> Other L ^c	176 / 169.9	1.04 (0.89,1.20)

Supplemental Material, Table S2 (continued).

Citation	Cohort	Cohort Size (n)	Deaths (n)	Duration of Follow-Up	Notes on Cohort Age or Exposure	Outcome	O/E	SMR/SIR (95% CI)
Svensson et al. 1995	Fishermen from the east coast of Sweden with historically high intake of fatty fish containing POPs	2,896	421	54 y (1935-1988)	Inclusion required membership in fishermen's organization for ≥ 1 year	<i>Mortality:</i> NHL	3 / 2.5	1.20 (0.25-3.49)
			197 incident cancers	20 y (1968-1988)		<i>Incidence:</i> NHL	5 / 5.8	0.85 (0.28-1.99)

Abbreviations: CI, confidence interval; E, expected number of cases in overall cohort; Hemato, hematologic malignancies (ICD-8 200-209); IL, Illinois; IN, Indiana; L & H, lymphatic and hematopoietic malignancies; LS & RS, lymphosarcoma and reticulosarcoma (ICD-9 200); MA, Massachusetts; N/A, not available; NHL, non-Hodgkin lymphoma; NR, no information reported by the authors on age or exposure duration characteristics of the cohort; NY, New York; O, observed number of cases in overall cohort; Other L, other lymphatic and hematopoietic malignancies (ICD-9 202-203); POPs, persistent organic pollutants; SIR, standardized incidence ratio; SMR, standardized mortality ratio; y, years.

^a Among white females in an analysis restricted to 1960-1999, during which time it was possible to re-code malignancies as NHL (data for males not reported).

^b Data obtained from Ruder et al., 2006.

^c Includes ICD-9 202 only.

Supplemental Material, Table S3. Interaction Between PCBs and EBV and Risk of NHL

Citation	PCB Congener Grouping	Exposure Level ^a	Cases (n)	Controls (n)	OR (95% CI) ^b	Cases (n)	Controls (n)	OR (95% CI) ^b
Rothman et al. 1997			EBV-EA <20				EBV-EA ≥20	
	Σ PCBs	<810 ng/g lipid	18	62	1.0 (reference)	4	11	1.0 (0.3, 3.6)
		≥810 ng/g lipid	39	67	2.8 (1.2, 6.2)	12	3	22.3 (4.3, 115.0)
Hardell et al. 2001		EBV-EA ≤80				EBV-EA >80		
	Σ PCBs	≤1,018 ng/g lipid	10	15	1.0 (reference)	16	22	1.1 (0.39, 3.4)
		>1,018 ng/g lipid	17	25	1.6 (0.52, 5.1)	22	12	4.0 (1.2, 14.0)
	Σ Immunotoxic PCBs ^c	≤348 ng/g lipid	9	18	1.0 (reference)	13	19	1.4 (0.47, 4.3)
		>348 ng/g lipid	18	22	3.2 (0.99, 11.0)	25	15	6.4 (1.9, 2.4)
Hardell et al. 2009		EBV-EA ≤40				EBV-EA >40		
	Σ PCBs	≤646 ng/g lipid	14	25	1.0 (reference)	24	24	2.5 (0.97, 6.4)
		>646 ng/g lipid	20	29	2.1 (0.7, 6.1)	39	20	5.2 (1.9, 14.0)
	Σ Lower chlorinated PCBs ^c	≤8.1 ng/g lipid	16	26	1.0 (reference)	34	23	3.1 (1.3, 7.4)
		>8.1 ng/g lipid	18	28	1.6 (0.6, 4.2)	29	21	3.0 (1.2, 7.8) ^d
	Σ Moderately chlorinated PCBs ^c	≤559 ng/g lipid	14	25	1.0 (reference)	25	24	2.5 (0.99, 6.5)
		>559 ng/g lipid	20	29	2.0 (0.7, 5.8)	38	20	5.0 (1.8, 14.0)
	Σ Higher chlorinated PCBs ^c	≤13 ng/g lipid	14	23	1.0 (reference)	20	26	1.5 (0.6, 3.8)
		>13 ng/g lipid	20	31	1.1 (0.4, 3.0)	43	18	3.9 (1.4, 10.0)
	Σ Immunotoxic PCBs ^c	≤226 ng/g lipid	17	24	1.0 (reference)	26	25	1.9 (0.8, 4.6)
		>226 ng/g lipid	17	30	1.2 (0.4, 3.4)	37	19	3.7 (1.4, 9.6)
Nordstrom et al. 2000 ^e		EBV-EA <40				EBV-EA ≥40		
	Σ PCBs	≤831.6 ng/g lipid	15	23	1.0 (reference)	16	4	4.4 (0.99, 23.4)
		>831.6 ng/g lipid	10	21	0.4 (0.1, 1.4)	13	6	4.4 (1.2, 18.5)
	Σ Immunotoxic PCBs ^c	≤285.4 ng/g lipid	14	20	1.0 (reference)	14	7	1.7 (0.4, 7.3)
		>285.4 ng/g lipid	11	24	0.4 (0.1, 1.5)	15	3	11.3 (2.3, 73.1)

Abbreviations: CI, confidence interval; EBV-EA, Epstein-Barr Virus Early Antigen Diffuse and Restricted components (R+D); ng/g, nanograms per gram; NHL, non-Hodgkin lymphoma; OR, odds ratio; PCB, polychlorinated biphenyl.

^a Dichotomized at the median level in controls. ^b Adjusted odds ratios. ^c As defined by Moysich et al. (1999) ^d Less than expected for biologic interaction ^eHairy cell leukemia, a subtype of NHL.

Supplemental Material, References.

- Bertazzi PA, Riboldi L, Pesatori AC, Radice L, Zocchetti C. 1987. Cancer mortality of capacitor manufacturing workers. *Am J Ind Med* 11:165-176.
- Bertazzi PA, Zocchetti C, Guercilena S, Della Foglia M, Pesatori AC, Riboldi L. 1982. Mortality study of male and female workers exposed to PCB's. In: Prevention of occupational cancer - International Symposium Geneva: International Labour Office.
- Bertrand KA, Spiegelman D, Aster JC, Altshul LM, Korrick SA, Rodig SJ, et al. 2010. Plasma organochlorine levels and risk of non-Hodgkin lymphoma in a cohort of men. *Epidemiology* 21:172-180.
- Brown DP. 1987. Mortality of workers exposed to polychlorinated biphenyls - an update. *Arch Environ Health* 42:333-339.
- Brown DP, Jones M. 1981. Mortality and industrial hygiene study of workers exposed to polychlorinated biphenyls. *Arch Environ Health* 36:120-129.
- Cocco P, Brennan P, Ibba A, de Sanjose LS, Maynadie M, Nieters A, et al. 2008. Plasma polychlorobiphenyl and organochlorine pesticide level and risk of major lymphoma subtypes. *Occup Environ Med* 65:132-140.
- Colt JS, Rothman N, Severson RK, Hartge P, Cerhan JR, Chatterjee N, et al. 2009. Organochlorine exposure, immune gene variation, and risk of non-Hodgkin lymphoma. *Blood* 113:1899-1905.
- Colt JS, Severson RK, Lubin J, Rothman N, Camann D, Davis S, et al. 2005. Organochlorines in carpet dust and non-Hodgkin lymphoma. *Epidemiology* 16:516-525.
- De Roos AJ, Hartge P, Lubin JH, Colt JS, Davis S, Cerhan JR, et al. 2005. Persistent organochlorine chemicals in plasma and risk of non-Hodgkin's lymphoma. *Cancer Res* 65:11214-11226.
- Engel LS, Laden F, Andersen A, Strickland PT, Blair A, Needham LL, et al. 2007a. Polychlorinated biphenyl levels in peripheral blood and non-Hodgkin's lymphoma: a report from three cohorts. *Cancer Res* 67:5545-5552.
- Fritschi L, Benke G, Hughes AM, Krieger A, Vajdic CM, Grulich A, et al. 2005. Risk of non-Hodgkin lymphoma associated with occupational exposure to solvents, metals, organic dusts and PCBs (Australia). *Cancer Causes Control* 16:599-607.
- Greenland S, Salvan A, Wegman DH, Hallock MF, Smith TJ. 1994. A case-control study of cancer mortality at a transformer-assembly facility. *Int Arch Occup Environ Health* 66:49-54.
- Gustavsson P, Hogstedt C. 1997. A cohort study of Swedish capacitor manufacturing workers exposed to polychlorinated biphenyls (PCBs). *Am J Ind Med* 32:234-249.

- Hardell K, Carlberg M, Hardell L, Bjornfoth H, Jogsten IE, Eriksson M, et al. 2009. Concentrations of organohalogen compounds and titers of antibodies to Epstein-Barr virus antigens and the risk for non-Hodgkin lymphoma. *Oncol Rep* 21:1567-1576.
- Hardell L, Eriksson M, Lindstrom G, Van BB, Linde A, Carlberg M, et al. 2001. Case-control study on concentrations of organohalogen compounds and titers of antibodies to Epstein-Barr virus antigens in the etiology of non-Hodgkin lymphoma. *Leuk Lymphoma* 42:619-629.
- Hardell L, Liljegren G, Lindstrom G, Van BB, Fredrikson M, Hagberg H. 1997. Polychlorinated biphenyls, chlordanes, and the etiology of non-Hodgkin's lymphoma. *Epidemiology* 8:689.
- Hardell L, van Bavel B, Lindstrom G, Fredrikson M, Hagberg H, Liljegren G, et al. 1996. Higher concentrations of specific polychlorinated biphenyl congeners in adipose tissue from non-Hodgkin's lymphoma patients compared to controls without malignant disease. *Int J Oncol* 9:603-608.
- Kimbrough RD, Doemland ML, LeVois ME. 1999. Mortality in male and female capacitor workers exposed to polychlorinated biphenyls. *J Occup Environ Med* 41:161-171.
- Kimbrough RD, Doemland ML, Mandel JS. 2003. A mortality update of male and female capacitor workers exposed to polychlorinated biphenyls. *J Occup Environ Med* 45:271-282.
- Laden F, Bertrand KA, Altshul LM, Aster JC, Korrick SA, Sagiv SK. 2010. Plasma organochlorine levels and risk of non-Hodgkin lymphoma in the Nurses' Health Study. *Cancer Epidemiol Biomarkers Prev* 19:1381-1384.
- Liss GM. 1989. Mortality and cancer morbidity among transformer manufacturing workers. Toronto:Ontario Ministry of Labour Policy and Regulations Branch Health Studies Service.
- Loomis D, Browning SR, Schenck AP, Gregory E, Savitz DA. 1997. Cancer mortality among electric utility workers exposed to polychlorinated biphenyls. *Occup Environ Med* 54:720-728.
- Mallin K, McCann K, D'Aloisio A, Freels S, Piorkowski J, Dimos J, et al. 2004. Cohort mortality study of capacitor manufacturing workers, 1944-2000. *J Occup Environ Med* 46:565-576.
- Morton LM, Wang SS, Cozen W, Linet MS, Chatterjee N, Davis S, et al. 2008. Etiologic heterogeneity among non-Hodgkin lymphoma subtypes. *Blood* 112:5150-5160.
- Moysich KB, Mendola P, Schisterman EF, Freudenheim JL, Ambrosone CB, Vena JE, et al. 1999. An evaluation of proposed frameworks for grouping polychlorinated biphenyl (PCB) congener data into meaningful analytic units. *Am J Ind Med* 35:223-231.
- Nordstrom M, Hardell L, Lindstrom G, Wingfors H, Hardell K, Linde A. 2000. Concentrations of organochlorines related to titers to Epstein-Barr virus early antigen IgG as risk factors for hairy cell leukemia. *Environ Health Perspect* 108:441-445.

Prince MM, Hein MJ, Ruder AM, Waters MA, Laber PA, Whelan EA. 2006a. Update: cohort mortality study of workers highly exposed to polychlorinated biphenyls (PCBs) during the manufacture of electrical capacitors, 1940-1998. *Environ Health* 5:13. doi: 10.1186/1476-069X-5-13.

Prince MM, Ruder AM, Hein MJ, Waters MA, Whelan EA, Nilsen N, et al. 2006b. Mortality and exposure response among 14,458 electrical capacitor manufacturing workers exposed to polychlorinated biphenyls (PCBs). *Environ Health Perspect* 114:1508-1514.

Quintana PJE, Delfino RF, Korrick S, Ziogas A, Kutz FW, Jones EL, et al. 2004. Adipose tissue levels of organochlorine pesticides and polychlorinated biphenyls and risk of non-Hodgkin's lymphoma. *Environ Health Perspect* 112:854-861.

Rothman N, Cantor KP, Blair A, Bush D, Brock JW, Helzlsouer K, et al. 1997. A nested case-control study of non-Hodgkin lymphoma and serum organochlorine residues. *Lancet* 350:240-244.

Ruder AM, Hein MJ, Nilsen N, Waters MA, Laber P, Davis-King K, et al. 2006. Mortality among workers exposed to polychlorinated biphenyls (PCBs) in an electrical capacitor manufacturing plant in Indiana: an update. *Environ Health Perspect* 114:18-23.

Sinks T, Steele G, Smith AB, Watkins K, Shults RA. 1992. Mortality among workers exposed to polychlorinated biphenyls. *Am J Epidemiol* 136:389-398.

Spinelli JJ, Ng CH, Weber JP, Connors JM, Gascoyne RD, Lai AS, et al. 2007. Organochlorines and risk of non-Hodgkin lymphoma. *Int J Cancer* 121:2767-2775.

Svensson BG, Mikoczy Z, Stromberg U, Hagmar L. 1995. Mortality and cancer incidence among Swedish fishermen with a high dietary intake of persistent organochlorine compounds. *Scand J Work Environ Health* 21:106-115.

Tironi A, Pesatori AC, Consonni D, Zocchetti C, Bertazzi PA. 1996. Mortalita di lavoratrici esposte a PCB [The mortality of female workers exposed to PCBs] (Italian). *Epidemiol Prev* 20:200-202.

Viel JF, Floret N, Deconinck E, Focant JF, De Pauw E, Cahn JY. 2011. Increased risk of non-Hodgkin lymphoma and serum organochlorine concentrations among neighbors of a municipal solid waste incinerator. *Environ Int* 37:449-453.

Yassi A, Tate R, Fish D. 1994. Cancer mortality in workers employed at a transformer manufacturing plant. *Am J Ind Med* 25:425-437.